

Skating 1

Introductory Question

A rotary lawn mower spins its sharp blade rapidly over the lawn and cuts the tops off the grasses. Would the blade still cut the grasses if they weren't attached to the ground?

- A. Yes
- B. No

Skating 2

Introductory Question (revisited)

A rotary lawn mower spins its sharp blade rapidly over the lawn and cuts the tops off the grasses. Would the blade still cut the grasses if they weren't attached to the ground?

- A. Yes
- B. No

Skating 3

Clicker Question

To find the full can of soda, without lifting anything, you should

- A. compare the velocities of the two cans.
- B. compare the positions of the two cans.
- C. push each can and observe its acceleration.
- D. consult a Ouija board.

Skating 4

Introductory Question

Suppose I throw a ball upward into the air. After the ball leaves my hand, is there any force pushing the ball upward?

- A. Yes
- B. No

Skating 5

Clicker Question

If we could eliminate air resistance, would a light sheet of paper and a heavy book fall at the same rate?

- A. Yes
- B. No

Skating 6

Clicker Question

You jump upward from a springboard and dive gracefully into the pool. At the peak of your jump, your velocity is

- A. changing, but your acceleration is constant.
- B. constant, and your acceleration is constant.
- C. constant, but your acceleration is changing.
- D. changing, and your acceleration is changing.

Skating 7

Introductory Question (revisited)

Suppose I throw a ball upward into the air. After the ball leaves my hand, is there any force pushing the ball upward?

- A. Yes
- B. No

Skating 8

Introductory Question

Can a ball ever push downward on a table with a force greater than the ball's weight?

- A. Yes
- B. No

Skating 9

Reading Question 1.3a

When a piano is resting motionless on the sidewalk, the net force on the piano is

- A. equal to the upward support force on the piano.
- B. equal to the piano's downward weight.
- C. equal to half the piano's downward weight.
- D. zero.

Skating 10

Reading Question 1.3b

When you push on a cart, you do work on that cart

- A. only if it is stationary.
- B. only if it is moving in the direction of your push.
- C. only if it is moving perpendicular to your push.
- D. only if it is moving opposite your push.
- E. regardless of its motion.

Skating 11

Clicker Question

If you push on a friend, will that friend always push back on you?

- A. Yes
- B. No

Skating 12

Clicker Question

If you push on a friend who is moving away from you, how will the force you exert on your friend compare to the force your friend exerts on you?

- A. You push harder
- B. Your friend pushes harder
- C. The forces are equal in magnitude

Introductory Question (revisited)

Can a ball ever push downward on a table with a force greater than the ball's weight?

- A. Yes
- B. No

Clicker Question

When I drop an egg on the table, it will break. What will break the egg?

- A. The egg's inertia.
- B. The egg's weight.
- C. The table's support force on the egg.
- D. The earth's gravitational force on the egg.

Clicker Question

If I pull uphill on the cart just hard enough to balance the downhill ramp force, the cart will

- A. be motionless.
- B. have a constant velocity, which may be zero.

Introductory Question

You and a child half your height lean out over the edge of a pool at the same angle. If you both let go simultaneously, who will tip over faster and hit the water first?

- A. You
- B. The small child

Reading Question 2.1a

When you spin a smooth stone on a slippery table, the stone naturally pivots about its

- A. center of mass.
- B. center of gravity.
- C. rotational mass.
- D. torque.

Reading Question 2.1b

When a wind turbine is completely free of external torques, it

- A. is horizontal and motionless.
- B. can be horizontal or tilted, but it is motionless.
- C. has a constant angular velocity, possibly zero.
- D. has a constant angular acceleration.

Clicker Question

To make Mini-Me undergo clockwise angular acceleration, I should knock

- A. the top of his head toward his feet.
- B. the side of his head toward your right.
- C. the middle of his body toward your right.
- D. the side of his feet toward your right.

Clicker Question

When a student strikes the right side of this balanced bar with a mallet, the bar will undergo tremendous clockwise angular acceleration. The egg will break

- A. while it is accelerating upward on the bar.
- B. when it hits the ground after its flight.
- C. in midair.

Introductory Question (revisited)

You and a child half your height lean out over the edge of a pool at the same angle. If you both let go simultaneously, who will tip over faster and hit the water first?

- A. You
- B. The small child

Introductory Question

The light turns green and you're in a hurry. Will your car accelerate faster if you skid your wheels and "burn rubber" or if you just barely avoid skidding your wheels?

- A. Skid your wheels
- B. Barely avoid skidding

Reading Question 2.2a

I am pushing a file cabinet to your right along a level floor. In which direction does the floor's frictional force on the file cabinet act?

- A. Toward your left.
- B. Upward and toward your left (at an angle).
- C. Toward your right.
- D. Upward and toward your right (at an angle).

Reading Question 2.2b

Which types of friction waste ordered energy (work) as disordered energy (thermal energy)?

- A. Static friction but not sliding friction
- B. Sliding friction but not static friction
- C. Both static friction and sliding friction
- D. Neither static friction nor sliding friction

Clicker Question

- When a block skids to a stop on a motionless desk, what work is done by those two objects?
- A. The desk does negative work on the block.
- B. The block does positive work on the desk.
- C. Both objects do positive work on one another.
- D. Both objects do negative work on one another.
- E. The block does positive work on the desk, the desk does negative work on the block.

Clicker Question

- When you pull a wheeled cart forward and it is accelerating forward, what frictional force does the ground exert on the wheels as they roll?
- A. A sliding frictional force that points backward.
- B. A static frictional force that points forward.
- C. A static frictional force that points backward.
- D. A sliding frictional force that points forward.
- E. Zero frictional force.

Introductory Question (revisited)

The light turns green and you're in a hurry. Will your car accelerate faster if you skid your wheels and "burn rubber" or if you just barely avoid skidding your wheels?

- A. Skid your wheels
- B. Barely avoid skidding

Introductory Question

You are riding on the edge of a spinning playground merry-go-round. If you pull yourself to the center of the merry-go-round, what will happen to its rotation?

- A. It will spin faster.
- B. It will spin slower.
- C. It will spin at the same rate.

Reading Question 2.3a

Your momentum is equal to

- A. your weight times your velocity.
- B. your weight times your speed.
- C. your mass times your velocity.
- D. your mass times your speed.

Reading Question 2.3b

Can you transfer momentum to a rigid, immovable wall?

- A. Yes
- B. No

Clicker Question

You pound on a nail with two different mallets, one softer than the other. Their masses are equal and you swing them equally fast. Compared to the **harder mallet**, the momentum transferred by the **softer mallet** to the nail is

- A. the same and it exerts the same force.
- B. **the same, but it exerts a smaller force.**
- C. less, but it exerts the same force.
- D. less and it exerts a smaller force.

Introductory Question (revisited)

You are riding on the edge of a spinning playground merry-go-round. If you pull yourself to the center of the merry-go-round, what will happen to its rotation?

- A. **It will spin faster.**
- B. It will spin slower.
- C. It will spin at the same rate.

Introductory Question

A diver stands motionless at the end of a spring board, which bends downward. If her identical twin joins her, how far downward will the board then bend?

- A. The same amount.
- B. **Twice as far.**
- C. Four times as far.

Reading Question 3.1a

An object that is in equilibrium is

- A. accelerating opposite its velocity.
- B. accelerating at a constant rate.
- C. motionless.
- D. **motionless or moving at constant velocity.**

Reading Question 3.1b

The force a spring exerts on one of its ends is proportional to

- A. its weight.
- B. its mass.
- C. **its distortion away from equilibrium.**
- D. its length.

Introductory Question (revisited)

A diver stands motionless at the end of a spring board, which bends downward. If her identical twin joins her, how far downward will the board then bend?

- A. The same amount.
- B. **Twice as far.**
- C. Four times as far.

Clicker Question

You are standing on a bathroom scale in an elevator. As the elevator starts moving upward, the scale reads

- A. your weight.
- B. **more than your weight.**
- C. less than your weight.

Introductory Question

If you place a tennis ball on a basketball and drop this stack on the ground, how high will the tennis ball bounce?

- A. To approximately its original height
- B. **Much higher than its original height**
- C. Much less than its original height

Reading Question 3.2a

A “bouncy” or “lively” ball bounces higher from a rigid, immovable surface than a “dead” ball does because the “bouncy” ball

- A. pushes harder on the surface.
- B. transfers less energy to the surface.
- C. **returns more collision energy as rebound energy.**
- D. obtains more rebound energy from the surface.

Reading Question 3.2b

When a baseball bounces from a moving bat, the final speed of the baseball

- A. is between the initial speeds of bat and baseball.
- B. is equal to the initial speed of the baseball.
- C. **can exceed the initial speed of either object.**
- D. is less than the initial speed of either object.

Clicker Question

When a soft, elastic ball drops onto a rigid floor, which object(s) has significant work done on its surface, as viewed from the perspective of that object’s center of mass?

- A. **The ball only.**
- B. The floor only.
- C. Both the ball and floor.

Clicker Question

If a ball’s coefficient of restitution is 0.5 and it drops onto a rigid floor, how high will it bounce, relative to the height from which it dropped?

- A. 100% of the drop height.
- B. 50% of the drop height.
- C. **25% of the drop height.**

Clicker Question

Two cars are traveling at 60 mph and 50 mph, respectively, according to a pedestrian. When they collide, their approaching speed will be

- A. 110 mph.
- B. between 50 mph and 60 mph.
- C. between 10 mph and 110 mph.
- D. between 0 mph and 60 mph.

Clicker Question

Two cars are traveling at 60 mph and 50 mph, respectively, according to a pedestrian. The range of possible collision energies for these two cars extends over a factor of

- A. $5/6$.
- B. $6/5$.
- C. 10.
- D. 121.

Introductory Question (revisited)

If you place a tennis ball on a basketball and drop this stack on the ground, how high will the tennis ball bounce?

- A. To approximately its original height
- B. Much higher than its original height
- C. Much less than its original height

Introductory Question

You are a passenger in a car that is turning left and you find yourself thrown against the door to your right. Is there a force pushing you toward the door?

- A. Yes
- B. No

Reading Question 3.3a

When you are riding a carousel that is turning at a steady rate, your acceleration is

- A. forward (in the direction of your velocity).
- B. toward the center of the carousel.
- C. away from the center of the carousel.
- D. zero.

Reading Question 3.3b

When you are in free fall, your apparent weight is

- A. downward and equal to your weight.
- B. upward and equal in amount to your weight.
- C. zero.

Introductory Question (revisited)

You are a passenger in a car that is turning left and you find yourself thrown against the door to your right. Is there a force pushing you toward the door?

- A. Yes
- B. No

Clicker Question

A dropped ball accelerates downward at the acceleration due to gravity. If you push downward on a ball with your open palm, it will accelerate downward

- A. at the acceleration due to gravity.
- B. faster than the acceleration due to gravity.
- C. slower than the acceleration due to gravity.

Clicker Question

As you push downward on a ball with your open palm, it

- A. accelerates with your palm and pushes upward on your palm.
- B. accelerates faster than your palm and does not push upward on your palm.